

**IN THE CLAIMS:**

- 1 1. (CURRENTLY AMENDED) A method for a particular file server to allocate a spare  
2 disk to replace a failed disk in a network storage system comprising the steps of:  
3 identifying a set of spare disks, the set of spare disks attached to a plurality of ~~fil-~~  
4 ~~ers~~ file servers of the network storage system;  
5 choosing a best spare disk of the set of spare disks, the best spare disk attached to  
6 any of the file servers ~~filers~~ of the plurality of ~~filers~~ file servers, the best spare disk cho-  
7 sen according to a plurality of user-selectable policies; and  
8 claiming ownership of the best spare disk.
- 1 2. (ORIGINAL) The method of claim 1 further comprising the steps of:  
2 choosing, in response to a failure of the step of claiming ownership, a next best  
3 spare disk of the spare disks available; and  
4 claiming ownership of the next best spare disk.
- 1 3. (ORIGINAL) The method of claim 2, wherein the step of claiming ownership of the  
2 best spare disk further comprises the steps of:  
3 setting a first ownership attribute to a file server-owned state; and  
4 setting a second ownership attribute to a file server-owned state.
- 1 4. (CURRENTLY AMENDED) The method of claim 1 wherein the step of choosing the  
2 best spare disk further comprises the steps of:  
3 selecting one or more disks from the set of spare disks that satisfy one or more  
4 hard-coded rules;  
5 sorting the one or more disks selected from the set of spare disks according to the  
6 plurality of user-selectable ~~a set of ordered~~ policies to identify a highest-ranked disk;  
7 choosing a highest-ranked disk as the best spare disk; and

8 choosing, in response to more than one of the one or more disks being highest-  
9 ranked, one disk at random, from the more than one of the one or more disks that are  
10 highest-ranked, as the best spare disk.

1 5. (CURRENTLY AMENDED) A method of verifying that a plurality of disks in a vol-  
2 ume are optimally configured comprising the steps of:

3 identifying all of the disks in the volume;

4 obtaining disk characteristics, respectfully, from all of the disks in the volume;

5 comparing the disk characteristics with a set of policies and characteristics of  
6 spare disks; and

7 alerting an administrator if a more optimal configuration of which disks are used  
8 in the volume and which disks are spare is possible.

1 6. (CURRENTLY AMENDED) The method of claim 5 further comprising the step of:

2 reconfiguring the disks into a the more optimal configuration.

1 7. (CURRENTLY AMENDED) A method of selecting a best spare disk for use by a filer  
2 in a network storage system including a plurality of filers, and serving an array of disks  
3 from a set of spare disks comprising the steps of:

4 selecting one or more disks from the set of spare disks attached to any of the filers  
5 of the plurality of filers, said set of disks satisfying one or more hard-coded rules;

6 sorting the one or more disks using a set of ~~ordered~~ user-selectable policies;

7 if only one disk is highest-ranked, selecting the one disk that is highest-ranked as  
8 the best spare disk; and

9 if a plurality of disks are highest-ranked, selecting one of the disks from the plu-  
10 rality of disks that are highest-ranked as the best spare disk.

1 8. (CANCELLED)

1 9. (CURRENTLY AMENDED) ~~The network storage system of claim 8, wherein the~~  
2 ~~means for allocating one or more of the plurality of spare disks further comprises:~~

3 A network storage system including a plurality of spare disks, comprising:

4 means for identifying the plurality of spare disks, the set of spare disks attached to  
5 a plurality of file servers of the network storage system;

6 means for selecting a best spare disk from the plurality of spare disks, the best  
7 spare disk chosen according to a plurality of user-selectable policies; and

8 means for claiming ownership of the best spare disk.

1 10. (CURRENTLY AMENDED) The network storage system of claim 9, wherein the  
2 means for selecting a best spare disk from the plurality of spare disks further comprises:

3 means for selecting a set of disks from the plurality of spare disks that satisfy one or  
4 more hard-coded rules;

5 means for sorting the set of disks according to ~~a set of~~ the plurality of user-selectable  
6 ~~ordered~~ policies; and

7 means for selecting a highest-ranked disk from the set of disks.

1 11. (CURRENTLY AMENDED) A computer-readable medium, including program  
2 instructions executing on a particular filer, for allocating a replacement disk to the par-  
3 ticular filer, the program instructions performing the steps of:

4 identifying a set of spare disks ~~the set of spare disks attached to a plurality of fil-~~  
5 ~~ers of the network storage system;~~

6 choosing a best spare disk of the set of spare disks ~~the best spare disk attached to~~  
7 ~~any of the plurality of filers,~~ the best spare disk chosen according to a plurality of user-  
8 selectable policies; and

9 claiming ownership of the best spare disk.

1 12. (CURRENTLY AMENDED) The computer-readable medium of claim 11, wherein  
2 the step of choosing the best spare disk further comprises the steps of:

3 selecting one or more disks from a set of spare disks that satisfy one or more hard-  
4 coded rules;

5 sorting the one or more disks selected from the set of spare disks according to a  
6 ~~set of ordered~~ the plurality of user-selectable policies to identify a highest-ranked disk;

7 choosing a highest-ranked disk as the best spare disk; and

8 choosing, in response to more than one of the one or more disks being highest-  
9 ranked, one disk at random, from the more than one of the one or more disks that are  
10 highest-ranked, as the best spare disk.

1 13. (PREVIOUSLY PRESENTED) A method for allocating a spare disk to replace a  
2 failed disk in a network storage system, comprising:

3 maintaining a plurality of volumes in the network storage system, each volume  
4 associated with a set of disk storage units;

5 maintaining a plurality of spare disks in the network storage system;

6 choosing a best spare disk of the plurality of spare disks to replace a failed disk,  
7 the failed disk associated with any volume of the network storage system; and

8 replacing the failed disk with the best spare disk.

1 14. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:

2 establishing at least one file server in the network storage system; and

3 performing the step of choosing a best spare disk by the at least one file server.

1 15. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:

2 establishing at least one file server in the network storage system; and

3 performing the step of replacing the failed disk with the best spare disk by the file  
4 server.

1 16. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:  
2 determining the best spare disk by selecting those disks from the plurality of spare  
3 disks which meet at least one selected rule.

1 17. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:  
2 sorting disks in accordance with policies, and assigning a score to each disk as a  
3 result of the sorting; and  
4 selecting the disk with a highest score as the best spare disk.

1 18. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:  
2 determining those disks of the plurality of spare disks which meet at least one se-  
3 lected rule to form a selected pool of disks;  
4 sorting disks of the selected pool of disks in accordance with policies, and assign-  
5 ing a score to each disk as a result of the sorting; and  
6 selecting the disk with a highest score as the best spare disk.

1 19. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:  
2 using a random selection process to select the best spare disk in the event that two  
3 or more disks appear to be equally the best spare disk.

1 20. (PREVIOUSLY PRESENTED) A method for allocating a spare disk to replace a  
2 failed disk in a network storage system, comprising:  
3 maintaining a plurality of volumes in the network storage system, each volume  
4 associated with a set of disk storage units;  
5 maintaining a plurality of spare disks in the network storage system;  
6 attempting to determine the best spare disk by selecting those disks from the plu-  
7 rality of spare disks which meet at least one rule;  
8 replacing the failed disk with the best spare disk;

9           in the event that no spare disk meets the at least one rule, selecting a spare disk  
10   which violates the at least one rule as a selected disk; and  
11           notifying an administrator that the selected spare disk violates the rule.

1   21. (PREVIOUSLY PRESENTED) A network storage system, comprising:  
2           means for maintaining a plurality of volumes in the network storage system, each  
3   volume associated with a set of disk storage units;  
4           means for maintaining a plurality of spare disks in the network storage system;  
5           means for choosing a best spare disk of the plurality of spare disks to replace a  
6   failed disk, the failed disk associated with any volume of the network storage system; and  
7           means for replacing the failed disk with the best spare disk.

1   22. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further  
2   comprising:  
3           means for establishing at least one file server in the network storage system; and  
4           means for performing the step of choosing a best spare disk by the at least one file  
5   server.

1   23. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further  
2   comprising:  
3           means for establishing at least one file server in the network storage system; and  
4           means for performing the step of replacing the failed disk with the best spare disk  
5   by the file server.

1   24. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further  
2   comprising:  
3           means for determining the best spare disk by selecting those disks from the plural-  
4   ity of spare disks which meet at least one selected rule.

1 25. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further  
2 comprising:

3 means for sorting disks in accordance with policies, and assigning a score to each  
4 disk as a result of the sorting; and

5 means for selecting the disk with a highest score as the best spare disk.

1 26. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further  
2 comprising:

3 means for determining those disks of the plurality of spare disks which meet at  
4 least one selected rule to form a selected pool of disks;

5 means for sorting disks of the selected pool of disks in accordance with policies,  
6 and assigning a score to each disk as a result of the sorting; and

7 means for selecting the disk with a highest score as the best spare disk.

1 27. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further  
2 comprising:

3 means for using a random selection process to select the best spare disk in the  
4 event that two or more disks appear to be equally the best spare disk.

1 28. (PREVIOUSLY PRESENTED) A network storage system, comprising:

2 means for maintaining a plurality of volumes in the network storage system, each  
3 volume associated with a set of disk storage units;

4 means for maintaining a plurality of spare disks in the network storage system;

5 means for attempting to determine a best spare disk by selecting those disks from  
6 the plurality of spare disks which meet at least one rule;

7 means for replacing the failed disk with the best spare disk;

1 in the event that no spare disk meets the at least one rule, means for selecting a  
2 spare disk which violates the at least one rule as a selected disk; and

3 means for notifying an administrator that the selected spare disk violates the rule.

1 29. (PREVIOUSLY PRESENTED) A file server in a network storage system, compris-  
2 ing:

3 a storage adapter to connect to a plurality of disk storage units in the network  
4 storage system;

5 an operating system to maintain a plurality of volumes, each volume associated  
6 with a set of disk storage units, the set of disk storage units selected from the plurality of  
7 disk storage units;

8 the operating system maintaining a plurality of spare disks units selected from the  
9 plurality of disk storage units;

10 the operating system choosing a best spare disk of the plurality of spare disks to  
11 replace a failed disk, the failed disk associated with any volume of the network storage  
12 system; and

13 the operating system replacing the failed disk with the best spare disk.

1 30. (PREVIOUSLY PRESENTED) The file server of claim 29, further comprising:

2 the operating system determining the best spare disk by selecting those disks from  
3 the plurality of spare disks which meet at least one selected rule.

1 31. (PREVIOUSLY PRESENTED) The file server system of claim 29, further compris-  
2 ing:

3 the operating system sorting disks in accordance with policies, and assigning a  
4 score to each disk as a result of the sorting; and

5 the operating system selecting the disk with a highest score as the best spare disk.

1 32. (PREVIOUSLY PRESENTED) The file server system of claim 29, further compris-  
2 ing:

3 the operating system determining those disks of the plurality of spare disks which  
4 meet at least one selected rule to form a selected pool of disks;



5           the operating system sorting disks of the selected pool of disks in accordance with  
6 policies, and assigning a score to each disk as a result of the sorting;  
7           the operating system selecting the disk with a highest score as the best spare disk.

1   33. (PREVIOUSLY PRESENTED) The file server of claim 29, further comprising:  
2           the operating system using a random selection process to select the best spare disk  
3 in the event that two or more disks appear to be equally the best spare disk.

1   34. (PREVIOUSLY PRESENTED) A file server in a network storage system, compris-  
2 ing:  
3           a storage adapter to connect to a plurality of disk storage units in the network  
4 storage system;  
5           an operating system to maintain a plurality of volumes, each volume associated  
6 with a set of disk storage units, the set of disk storage units selected from the plurality of  
7 disk storage units;  
8           the operating system maintaining a plurality of spare disks units selected from the  
9 plurality of disk storage units;  
10          the operating system choosing a best spare disk of the plurality of spare disks to  
11 replace a failed disk, the failed disk associated with any volume of the network storage  
12 system;  
13          the operating system attempting to determine a best spare disk by selecting those  
14 disks from the plurality of spare disks which meet at least one rule;  
15          the operating system replacing the failed disk with the best spare disk;  
16          in the event that no spare disk meets the at least one rule, the operating system se-  
17 lecting a spare disk which violates the at least one rule as a selected disk; and  
18          the operating system notifying an administrator that the selected spare disk vio-  
19 lates the rule.

1   35. (PREVIOUSLY PRESENTED) A computer readable media, comprising:

2           said computer readable media containing instructions for execution on a processor  
3   for the practice of a method for allocating a spare disk to replace a failed disk in a net-  
4   work storage system, the method having the steps of,  
5           maintaining a plurality of volumes in the network storage system, each volume  
6   associated with a set of disk storage units;  
7           maintaining a plurality of spare disks in the network storage system;  
8           choosing a best spare disk of the plurality of spare disks to replace a failed disk,  
9   the failed disk associated with any volume of the network storage system; and  
10          replacing the failed disk with the best spare disk.

1   36. (CANCELLED)

1   37. (NEW) The method of claim 13 wherein the best spare disk is chosen based upon  
2   physical proximity to the failed disk.

1   38. (NEW) The method of claim 13 wherein the best spare disk is chosen based upon a  
2   comparison of the storage space of the spare disks and the failed disk.

1   39. (NEW) The method of claim 13 wherein the best spare disk is chosen based upon a  
2   comparison of the speed of the spare disks and the failed disk.

1   40. (NEW) A computer implemented method for allocating a spare storage device to  
2   replace a failed storage device in a network storage system, comprising:  
3           identifying a set of spare storage devices in the network storage system; and  
4           selecting a particular spare storage device of the set of spare storage devices to re-  
5   place the failed storage device, the particular spare storage device selected using a prox-  
6   imity policy in which preference is given to a spare storage device physically closest to  
7   the failed storage in the network storage system.

1 41. (NEW) The method of claim 40 wherein the proximity policy gives preference to a  
2 spare storage device on a same shelf as the failed storage device.

1 42. (NEW) The method of claim 40 wherein the proximity policy gives preference to a  
2 spare storage device on a same loop as the failed storage device.

1 43. (NEW) The method of claim 40 wherein the proximity policy gives preference to a  
2 spare storage device on a same switch as the failed storage device.

1 44. (NEW) The method of claim 40 wherein the proximity policy gives preference to a  
2 spare storage device on a same switch as the failed storage device.

1 45. (NEW) A computer implemented method for allocating a spare storage device to  
2 replace a failed storage device in a network storage system, comprising:  
3 identifying a set of spare storage devices in the network storage system; and  
4 selecting a particular spare storage device of the set of spare storage devices to re-  
5 place the failed storage device, the particular spare storage device selected using a size  
6 policy in which preference is given to a spare storage device with minimum storage space  
7 in excess of the storage space of the failed disk.

1 46. (NEW) A computer implemented method for allocating a spare storage device to  
2 replace a failed storage device in a network storage system, comprising:  
3 identifying a set of spare storage devices in the network storage system; and  
4 selecting a best spare storage device of the set of spare storage devices to replace  
5 the failed storage device, the best spare storage device selected using a speed policy in  
6 which preference is given to a spare storage device with a speed closest to that of the  
7 failed disk.

- 1 47. (NEW) The method of claim 46 wherein the speed is a rotation speed.
- 1 48. (NEW) The method of claim 46 wherein the speed is a data read speed.
- 1 49. (NEW) The method of claim 46 wherein the speed is a data write speed.
- 1 50. (NEW) A computer readable medium comprising executable program instructions  
2 for allocating a spare storage device to replace a failed storage device in a network stor-  
3 age system, the executable program instructions adapted for:  
4 identifying a set of spare storage devices in the network storage system; and  
5 selecting a particular spare storage device of the set of spare storage devices to re-  
6 place the failed storage device, the particular spare storage device selected using a prox-  
7 imity policy in which preference is given to a spare storage device physically closest to  
8 the failed storage in the network storage system.
- 1 51. (NEW) A computer readable medium comprising executable program instructions  
2 for allocating a spare storage device to replace a failed storage device in a network stor-  
3 age system, the executable program instructions adapted for:  
4 identifying a set of spare storage devices in the network storage system; and  
5 selecting a particular spare storage device of the set of spare storage devices to re-  
6 place the failed storage device, the particular spare storage device selected using a size  
7 policy in which preference is given to a spare storage device with minimum storage space  
8 in excess of the storage space of the failed disk.
- 1 52. (NEW) A computer readable medium comprising executable program instructions  
2 for allocating a spare storage device to replace a failed storage device in a network stor-  
3 age system, the executable program instructions adapted for:  
4 identifying a set of spare storage devices in the network storage system; and

5           selecting a best spare storage device of the set of spare storage devices to replace  
6 the failed storage device, the best spare storage device selected using a speed policy in  
7 which preference is given to a spare storage device with a speed closest to that of the  
8 failed disk.